COTTAGE POLLUTION CONTROL PROGRAM

SILVER LAKE

MANITOULIN ISLAND

1980

Ministry of the Environment
Ontario

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Prepared by:

Ministry of the Environment
Northeastern Region
Abatement Pollution Section

SUMMARY

During the summer of 1980 the Sudbury District Abatement Section of the Ministry of the Environment completed a "Cottage Pollution Control Survey" on Silver Lake at the request of the Manitoulin Planning Board.

During the survey, 51 cottages and homes were inspected by Ministry field staff.

At the time of the survey, 39(77%) establishments had sewage disposal systems which were operating satisfactorily. Problems associated with wash water and toilet waste disposal systems were observed at 8(15%) establishments, while 3(6%) establishments were found to have seriously substandard sewage disposal systems and 1(2%) system was unclassified. These problems were identified to the Sudbury and District Health Unit for follow-up action.

Many of the cottages and homes around the lake use wells for their drinking water. Well water quality was found to be adequate, indicating groundwater aquifers to be of good quality.

Lake water quality was also sampled and assessed to be good.

Development is concentrated along the eastern shore of the lake. The majority, 43(84%) of the establishments, are private cottages used mainly during the summer months. Scattered amongst the private cottages are permanent homes and establishments used occasionally for both summer and winter residences.

INTRODUCTION

At the request of the Manitoulin Planning Board, the Abatement Section of the Ministry of the Environment conducted a "Cottage Pollution Control Survey" on Silver Lake. The purpose of the survey was to collect information on the sewage disposal systems serving the cottages and homes along the shoreline of the lake. This information has been used to determine the degree of development present, and its impact on the water quality of Silver Lake.

The survey was done through the week of June 30th to July 4th, 1980 by representatives of the Sudbury District Office.

LOCATION

Silver Lake is located in Robinson Township, District of Manitoulin. It is located 155 kilometres west of the Town of Little Current. The location of the lake on Manitoulin Island is shown in Appendix A.

TOPOGRAPHY AND PHYSIOGRAPHY

Silver Lake occupies 549.3 Hectares of area with 11.54 kilometres of shoreline. The lake is shallow in nature with a mean depth of 2.93m, thus allowing moderate growth of aquatic vegetation. At the time of the survey the seasonal inlets serving the lake were found to be dry. Outflow was found to be occurring via Silver Creek at the north end of the lake.

The shoreline of the lake is made up primarily of gravel, sand, and boulders, with limestone outcroppings situated on the southeast shore. The watershed consists of 50% flat and 50% silty lands. For further information concerning physical characteristics of the area, see Appendix B.

DEVELOPMENT

In total there are 51 establishments situated along the shoreline. These consist of 43(84%) private cottages, 5(10%) permanent homes, 2(4%) recreation club buildings, and 1(2%) mobile home trailer. Appendix C, Table I summarizes the establishment types in the area.

Development is concentrated on the eastern shore of the lake, with the remaining areas covered mainly in bush or reforested area. Two farms were found to be in the area, with no agricultural runoff towards the lake occurring. Appendix D shows the location of development on the lake.

The area is used primarily for recreational purposes with the majority 42(82%) of the establishments used only in the summer months. Only 5(10%) of the establishments are used year round, and 4(8%) used in the summer and occasionaly in the winter. Appendix C, Table II summarizes establishment use.

LOT SIZES

In the past, 15,000 square feet has been considered the minimum area on which a septic tank system and a well could be located and comply with the distance requirements as set down in Ontario Regulation 229/74 of the Environmental Protection Act, 1971.

It was found that the majority, 19(37%), of the determinable lot sizes were greater than 15,000 square feet. Of the remaining, 1(2%) was between 2501 and 5000 square feet, and 3(6%) between 10,001 and 15,000 square feet. However, no problems were apparent with these small lots. Twenty-eight (55%) of the establishments had lot sizes which could not be determined, but appeared to have adequate area to comply with the Regulations.

SURVEY PROCEDURES

The survey was set up to investigate each and every establishment around Silver Lake. At each establishment, a survey number was assigned and a detailed description of the establishment recorded for ease of future identification. A survey questionnaire (Appendix E and F) was then completed with the aid of the owner if available, or from a cursory examination, and any help that could be obtained from neighbours. The owner's name, address, type of sewage disposal and its adequacy, type of water supply and treatment were recorded, as well as a sketch showing the location of all buildings, water supplies, sewage disposal systems and roads with respect to lake location.

Upon completion of the inspection, a classification for each sewage disposal system and an overall classification were determined and recorded. If any problems were found with regards to sewage disposal, a "Pollution Abatement Report" form was completed and a copy left at the site. If no problems were found and the owner was not present, a letter was left indicating the establishment had been inspected.

Upon completion of the survey, all completed abatement report forms were forwarded to the Sudbury and District Health Unit for follow-up action.

Water samples were collected for chemical and bacteriological analysis from each establishment utilizing a well as a drinking water source. Bacteriological samples were forwarded to the Ministry of Health Laboratory in Sudbury to be examined for total and fecal coliform organisms. Samples taken for chemical analysis were shipped to the Ministry of the Environment Laboratory in Toronto and analysed for hardness, alkalinity, iron, chloride, pH, sodium, colour, turbidity, conductivity and nitrate.

No samples were collected at establishments using the lake as a drinking water source.

As part of the lake quality assessment, chemical samples were taken at selected points around the lake. These were then shipped to the Ministry of the Environment Laboratory in Toronto and analysed for hardness, alkalinity, iron, chloride, pH, colour, turbidity, conductivity, total Kjeldahl, nitrite, nitrate, total phosphorus, suspended solids, and dissolved organic carbon.

QUESTIONNAIRE RESULTS

Sewage Disposal

Each establishment was classified as to its acceptability using the classifications found in Appendix G.

The results of the establishment inspections were found to indicate that 39(77%) of the cottages/homes had sewage disposal systems which were operating satisfactorily.

Three establishments (6%) were found to have substandard sewage systems. These cottages had pit privies of seriously substandard construction. These systems require upgrading or replacement.

The remaining 8(15%) places were found to have nuisance problems. Of these, 6(11%) were nuisance wash water, 1(2%) nuisance toilet, and 1(2%) being both nuisance wash water and nuisance toilet (see Appendix G to clarify these designations). These systems allow either wash water to be discharged onto the ground surface, or have privies of poor construction. These problems require the installation of a proper leaching pit for the disposal of wash water, and the upgrading, or replacement, of their present privies.

One establishment could not be classified with regards to its sewage systems acceptability due to the lack of information available.

Appendix H, Table I summarizes the results of the establishment classifications for all 51 properties inspected.

The 51 establishments were found to have 96 sewage disposal systems. The types of disposal systems utilized are summarized in Appendix I, Table I.

Inspection of the 51 establishments revealed that there were 26(27%) pit privies, 20(21%) septic tank and tile fields, 22(23%) septic tanks with no tile bed, 13(14%) leaching pits, 1(1%) pail privy, and 1(1%) system which could not be identified.

Six (6%) of the establishments at the time of the survey did not appear to have any disposal system and 7(7%) of the establishments appeared to have no disposal for wash water. However, lot inspection revealed no sign of ponding sewage or improper discharge of wash water. This may be attributed to the fact that these establishments were newly constructed or showed little signs of use.

The majority 81(81%) of the sewage disposal systems are located a distance greater than 50 feet from the lake. The remaining 8(9%) were found to be less than 50 feet from the lake. No problems were evident with these 8 systems although there is greater potential for affecting lake water quality. Appendix I, Table II summarizes the distances sewage disposal systems are from the lake.

Water Supplies

Appendix J, Tables I and II summarize the drinking water source and type of treatment used as reported by the owner.

Of the 51 property owners surveyed, 15(29%) hauled water, 11(21%) used drilled wells, 6 used dug wells, 4 were on sand points, 4 used the lake, and 2(4%) were on springs. Nine (18%) sources of drinking water could not be determined.

Treatment provided by residents on these water supplies consisted of 1(2%) which boiled their water, 1(2%) which used chlorine, and 38(75%) which could not be determined. Eleven (21%) did not utilize any type of treatment.

The Ministry of the Environment recommends that all residences using surface water as a drinking source have their water disinfected (such as by chlorination), as any surface water may have harmful bacteria present at any time.

RESULTS OF SAMPLE ANALYSIS

Groundwater Supplies

Of the 51 establishments surveyed, 21(41%) sources sampled were wells.

Results of the bacteriological analysis of these well water supplies indicated only 2 supply systems with the presence of total coliforms. The presence of total coliforms can indicate contact with soil runoff or less recent pollution.

Appendix K summarizes the results of chemical analysis of drinking water.

One sample was found to exceed the minimum safe level for nitrates. Excessive nitrate concentrations can induce methemoglobinemia in newborn infants under 3 months of age, and water with nitrate levels exceeding 10 mg/L should not be used for infant consumption or formula preparation.

One sample exceeded the notification level of 20 mg/L for sodium. Sodium, a constituent of common salt, may aggravate hypertension and complicate heart disease. Drinking water with levels of sodium in excess of 20 mg/L may wish to contact their family physician regarding any health implications.

Water samples exceeded the levels for iron, colour, and turbidity in 6(43%), 12(86%) and 6(43%) wells respectively. These parameters are associated with aesthetic problems and do not constitute a health hazard.

In all cases where the concentration of bacteria, sodium and nitrate exceeded allowable limits set for potable water supplies, the owners and Sudbury and District Health Unit were advised in writing of the adverse analysis.

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LAKE SAMPLING

Chemical samples of lake water were obtained from five sample points situated around the lake. Sampling was carried out by means of a composite sampler which allows a representative sample of the euphotic (growth) zone in a lake.

The chemical data indicates that the lake water is characteristic of Manitoulin Island with a pH level between 8.4 and 8.6. The results of these samples allow the Ministry of the Environment to classify the lake water quality as good. Appendix L summarizes the results of chemical analysis of the lake water.

Results of previous spring phosphorus sampling conducted by the Ministry of the Environment also indicate lake water to be of good quality.

CONCLUSIONS

As a result of the survey, the following conclusions may be drawn.

1. The majority 39(77%) of the establishments had adequate sewage disposal systems. The systems found to be inadequate are classified as nuisance problems and should be corrected on an individual basis.

2. Groundwater quality was found to be good. Aesthetic problems with this source as a supply may be cleared up by the installation of filters.

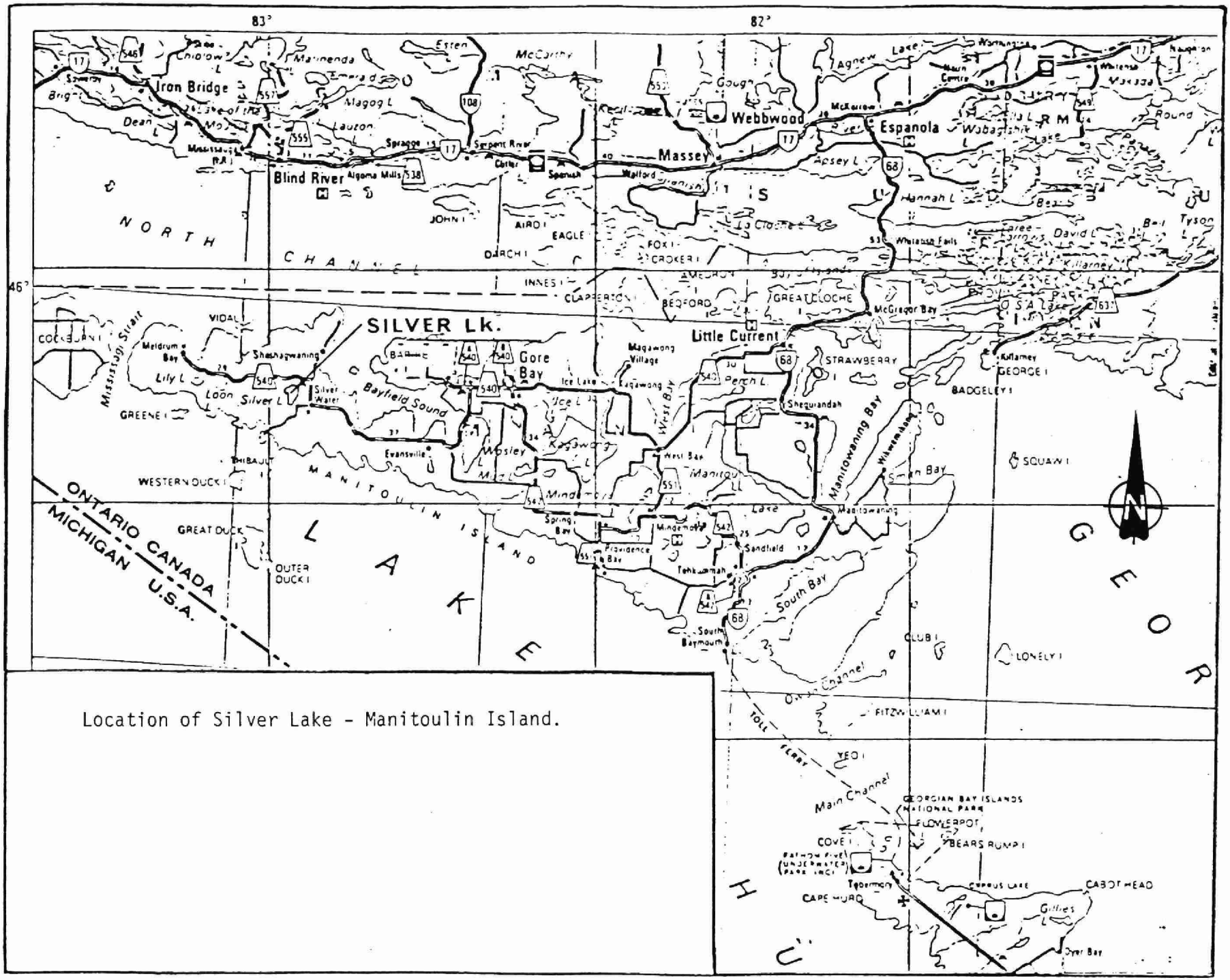
3. Lake water quality was found to be well within Ministry objectives, and classified as good.

4. Development is concentrated along the east shore. There is room for some additional development on the southern and western shores and it should be assessed as to its impact on an individual basis.

RECOMMENDATIONS

1. All sewage disposal systems should be corrected as to comply with current regulations.

2. The Ministry of the Environment should continue to include Silver Lake in its spring phosphorus sampling program in order to monitor the lake water quality on an ongoing basis.



Location of Silver Lake - Manitoulin Island.

APPENDIX A

APPENDIX B

SILVER LAKE

PHYSICAL DESCRIPTION

Latitude	$45^{o}52'50"$	Longitude	$82^{o}53'45"$

SURFACE AREA (Na):	549.3
VOLUME (m^3):	1.6145×10^7
MEAN DEPTH (m):	2.93
MAXIMUM DEPTH (m):	7.01
KILOMETERS OF SHORELINE:	11.54
OWNERSHIP:	100% Private
SOURCE:	Seasonal Inlets
OUTLETS:	1) North Bay Rate: 283.16 l/sec.
SHORELINE:	35% Detritus 30% Gravel 20% Sand 10% Boulders 5% Silt
WATERSHED:	50% Flat 50% Hilly
SPORTS FISHERY:	Yellow Perch, Brook Trout, Small Mouth Bass
AQUATIC VEGETATION:	Emergent - Moderate Submergent - Moderate Flotating - Sparse
DOMINANT TIMBER TYPES:	White Cedar White Birch Red Pine White Pine Silver Maple

APPENDIX C

Table I

Establishment Type

	Number	% of Total
Private Cottage	43	84
Home	5	10
Club	2	4
Trailer	1	2
	51	

Table II

Establishment Use

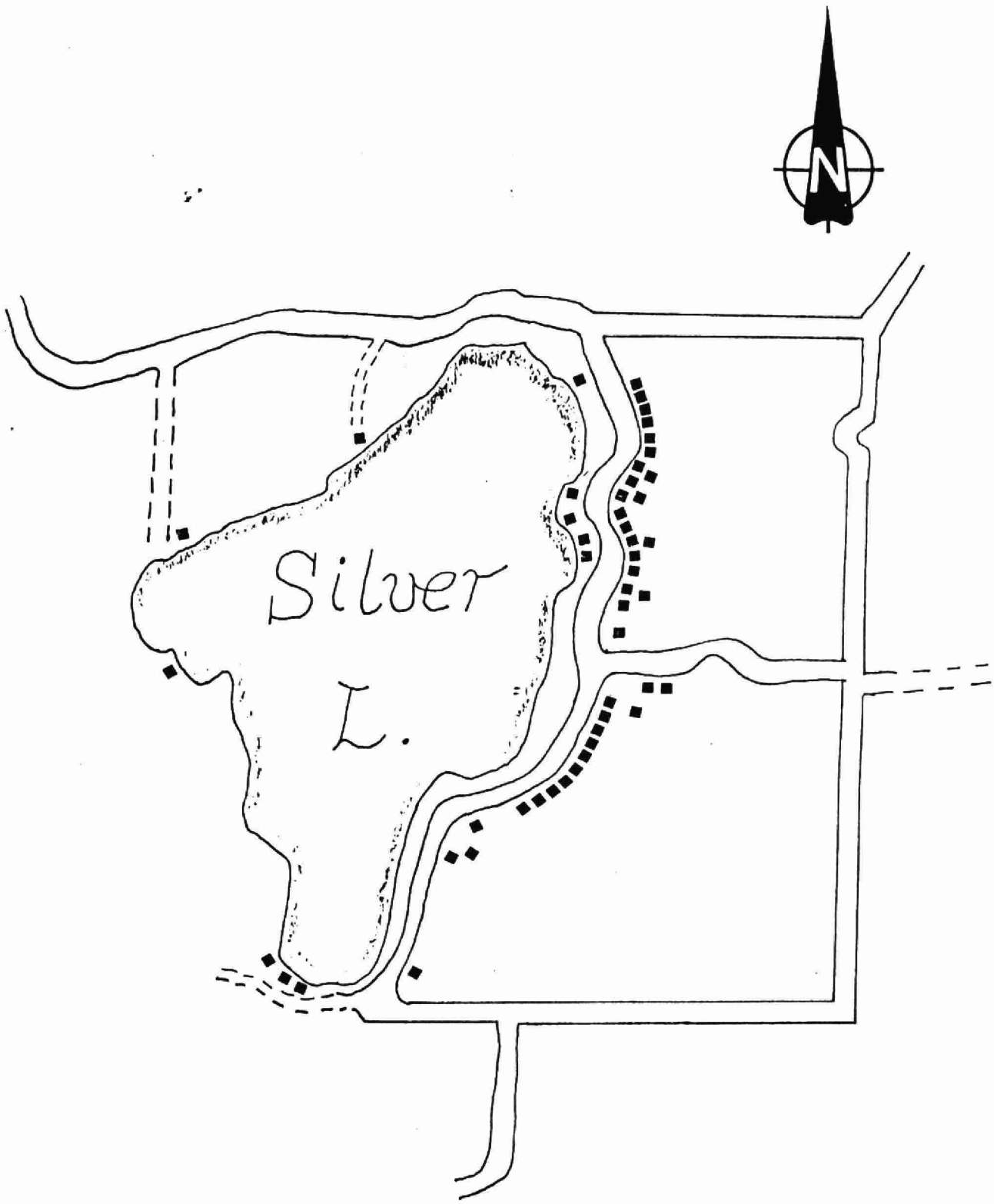
	Number	% of Total
Summer	42	82
Year Round	5	10
Summer/Occasional Winter	4	8
Winter	0	0
	51	

Table III

Establishment Lot Size

Lot Size (Square Feet)	Number	% of Total
< 2500	0	0
2501 - 5000	1	2
5001 - 10000	0	0
10001 - 15000	3	6
> 15000	19	37
Unknown	28	55
	51	

APPENDIX D



Silver Lake - Cottage Development 1980

Ministry of the Environment

Ontario

COTTAGE POLLUTION CONTROL PROGRAM

ESTABLISHMENT IDENTITY

LAKE OR RIVER No (1–6) | ESTABLISHMENT SURVEY No (7–11) | SUB EST No (12–13) | TRANS CODE (14–15)

ESTABLISHMENT DESCRIPTION

CARD No 0 1 (16–17) | HYDRO METER No (18) | DATE OF INSPECTION DAY MONTH YEAR (26) | LOT SIZE (32) | UNIT OF LOT SIZE SQ FT (40) ACRES (41) | USE (42) | No OF OCCUPANTS AVERAGE (43) MAXIMUM (47) | No BEDROOMS (51) | ESTABLISHMENT TYPE (53)

ACCESSIBLE BY ROAD Yes (55) No (56)

NAME OF ROAD _____

USE
1 SUMMER ONLY
2 YEAR ROUND
3 SUMMER OCCASIONAL WINTER
4 PREDOMINANT WINTER
5 NOT IN USE—CLOSED
6 UNDER CONSTRUCTION

TYPE OF ESTABLISHMENT
01 PRIVATE COTTAGE
02 CABIN ESTABLISHMENT
03 COTTAGE ESTABLISHMENT
04 CAMP
05 PICNIC AREA/PUBLIC PARK
06 MARINA
07 HOTEL/MOTEL
08 RESTAURANT
09 STORE
10 FARMHOUSE
11 CLUB
12 INDUSTRIAL
13 BOATHOUSE
14 PERMANENT HOME
15 CAMPGROUND/TRAILER PARK
16 OTHER

ESTABLISHMENT OWNER

TITLE (57) | INITIALS (61) | SURNAME (64–80)

TELEPHONE No _____

IF PERSON INTERVIEWED IS NOT OWNER NAME _____

MAILING ADDRESS

CARD No 0 2 (16–17)

OWNER'S PERMANENT MAILING ADDRESS (18 / 42 / 66)

CLASSIFICATION

PRELIMINARY (79) FINAL (80)

1 SATISFACTORY
2 SATISFACTORY PERFORMANCE
3 SERIOUSLY SUBSTANDARD
4 NUISANCE (WASH WATER)
5 NUISANCE (TOILET, SOLID WASTE)
6 DIRECT POLLUTER
7 UNCLASSIFIED TEMPORARILY)
8 UNCLASSIFIED

INITIALS _____

DESCRIPTION OF FACILITIES

CARD No 0 3 (16–17)

	FIXTURES & APPLIANCES											TOILETS								
	BATHROOM WASH BASIN	DISHPAN	BATH WITH SHOWER	BATH	STALL SHOWER	KITCHEN SINK	AUTOMATIC DISHWASHER	WASHING MACHINE (Wringer)	WASHING MACHINE (Auto.)	LAUNDRY TUB	GARBAGE GRINDER	STANDARD FLUSH	URINAL	LOW VOLUME FLUSH	PIT PRIVY	VAULT PRIVY	AQUA PRIVY (Pail a day)	INCIN TOILET—GAS	INCIN TOILET—ELECT	CHEMICAL TOILET	OTHER (Specify)
QUANTITY																					

(18 / 25 / 30 / 35 / 40)

SLOPE OF LOT GROUND (53–56)
0-5% (Flat) | 5-10% (Moderate) | 10-20% (Mod Steep) | >20% (Steep)

DRINKING WATER

SOURCE PRIMARY (42) OTHER (43) | SOURCE IF IMPORTED (44) | TREATMENT PRIMARY (45) OTHER (46) | LAUNDRY DONE AT COTTAGE YES (47) NO (48) | PIPED WATER YES (49) NO (50) | REFUSE PRIMARY (51) OTHER (52)

DRINKING WATER SOURCE
1 LAKE
2 COTTAGE DUG WELL
3 COTTAGE DRILLED WELL
4 CISTERN FOR RAINWATER
5 MUNICIPAL
6 OTHER (SPECIFY)

DRINKING WATER TREATMENT
1 NONE
2 BOILED OR FILTERED AND BOILED
3 FILTERED
4 DISINFECTED BY CHLORINE
5 DISINFECTED BY OTHER MEANS
6 FILTERED AND DISINFECTED BY CHLORINE
7 FILTERED AND DISINFECTED BY OTHER MEANS
8 OTHER (SPECIFY)

REFUSE
1 TO MUNICIPAL DUMP
2 TO LOCAL DUMP
3 TAKEN HOME
4 DEPOSITED IN LAKE
5 DEPOSITED ELSEWHERE
6 BURIED ON LOT
7 BURNED/INCINERATED
8 OTHER (SPECIFY)

APPENDIX E

FORM 1079 5/76

SEPTIC TANKS

CARD No 0 4

TANK No | CAPACITY: LIQUID, TOTAL, GALLONS | YEAR INSTALLED | LAST YEAR CLEANED | MATERIAL | APPROVAL | APPROV AGENCY

MATERIAL
1 CONCRETE 4 CONC BLOCK
2 STEEL 5 OTHER (SPECIFY)
3 FIBERGLASS

APPROVAL
1 NO REFERRAL 3 NOT APPROVED
2 REFERRAL NOT YET APPROVED 4 APPROVED

APP AGENCY
1 HEALTH UNIT
2 MIN OF ENV
3 MUNICIPAL

TILE FIELDS

FIELD No | TOTAL LENGTH OF TILES (FT) | DISTANCE BETWEEN LINES (FT) | HEIGHT ABOVE LAKE (FT)

BACTERIOLOGICAL SAMPLE RESULTS

CARD No 0 5

TOTAL COLIFORM | FAECAL COLIFORM | LOC N | D

1 to 9 — NORMAL LAKE OR RIVER SHORE SAMPLE No
D — DRINKING WATER
S — SEWAGE SAMPLE
C — CONTROL SAMPLE

EVALUATION OF SYSTEM

CARD No 0 6

DISTANCE TO
1 ALL MEASUREMENTS ARE SHORTEST DISTANCES
2 MEASUREMENT FROM POINT OF WASTE DISCHARGE ON GROUND SURFACE

SYSTEM No | SYSTEM TYPE | LAKE OR RIVER (FEET) | STREAM OR ABUTTING LOT (FEET) | DRINKING WELL (FEET) | BUILDING (FEET) | PROPERTY BOUNDARY (FEET)

TYPE OF WASTE: TOILET | BATHTUB SHOWER BATHROOM WASH BASIN | KITCHEN | LAUNDRY | UNKNOWN

CONSTRUCTION: POOR | INTERIOR MATERIALS | UNKNOWN CONSTRUCTION

OPERATION: SYSTEM OVERLOADED | SYSTEM ABUSED | UNKNOWN OPERATION

PERF: FIRST | SECOND

PERFORMANCE
1 POLLUTING DRINKING WELL
2 POLLUTING GROUND WATER
3 PONDING
4 EFFLUENT SURFACING
5 EFFLUENT BREAKING OUT
6 LEAKING
7 BAD ODOURS
8 NOT VERMIN PROOF

01 SEPTIC TANK
02 TILE FIELD
03 ON GROUND SURFACE
04 INTO LAKE RIVER OR BEACH
05 PIT PRIVY
07 CESSPOOL OR HOLDING TANK
08 LAGOON
10 MUNICIPAL
11 RESIDENCE
12 OTHER (SPECIFY)

SOIL PROFILE

CARD No 0 7

SOIL TYPES
1 ORGANIC 4 SILT
2 GRAVEL 5 CLAY
3 SAND

HOLE 1 (IN TILE FIELD IF ONE EXISTS)
HOLE 2 (IN TILE FIELD IF ONE EXISTS)

SOIL STRATUM (FT) | MAINLY (COMPOSED OF) | WITH (CONSIDERABLE AMOUNT OF) | MINOR AMOUNT OF

FIRST / NEXT / NEXT / NEXT

DEPTH TO IMPERVIOUS LAYER OR DEPTH TO GROUND WATER

SOIL DEPTH RANGE OVER WHOLE PROPERTY — FT TO FT

SOIL IS: NATURAL | FILL | INSUFFICIENT SOIL | UNSUITABLE SOIL

RECOMMENDED ACTION AND COMMENTS (BY SUPERVISOR)

CARD No 0 8

CARD No 0 9

ESTABLISHMENT IDENTITY

LAKE OR RIVER No | ESTABLISHMENT SURVEY No | SUB EST No | TRANS CODE

APPENDIX F

APPENDIX G

SEWAGE SYSTEM CLASSIFICATION

The sewage disposal systems of all the cottages surveyed were classified into one of the foolowing categories:

Satisfactory: The systems met the provincial standards at the time of the survey, relating to materials of construction, sizing, distances from water courses, as outlined in Regulation 229 of The Environmental Protection Act and were being properly maintained.

Satisfactory Performance: No obvious signs of pollution or of system malfunction were noted at the time of inspection. The disposal system may be antiquated or may not precisely meet regulations, but no fault in operation was noted.

Seriously Substandard: Systems with serious defects in construction, materials of construction, maintenance, sizing or systems located in poor soil conditions and/or closer than the required distances to water bodies. An immediate health or environmental concern existed.

Nuisance - (Wash Water): A system allowing the disposal of sink water or laundry water onto the ground surface. As well as a potential hazard, such discharges allow the untreated release of nutrients which may encourage weed growth and affect the aesthetics of the receiving water body.

Nuisance (Toilet & Solid Waste): Systems including poorly constructed or maintained privies. Also included in this category are garbage, scrap, etc., which allow conditions suitable for the procreation of vermin.

Direct Polluter: A system permitting human waste to directly enter the groundwater or surface water through piping or runoff on the ground surface, or after inadequate treatment.

Unclassified: Systems which could not be satisfactorily classified due to insufficient informationor systems which at the time of inspection were under construction.

APPENDIX H

Table I

Overall Establishment Classification

	Number	% of Total
Satisfactory	4	8
Satisfactory Performance	35	69
Seriously Substandard	3	6
Nuisance Wash Water	6	11
Nuisance Toilet	1	2
Nuisance Wash Water & Toilet	1	2
Direct Pollutor	0	0
Unclassified	1	2
	51	

Classification of a system as "satisfactory performance" is not necessarily a statement of endorsement or official approval of the system while, although functioning satisfactorily during the survey, may not meet current standards.

APPENDIX I

Table I

Sewage Disposal Systems

	Number	% of Total
Holding Tank	0	0
Septic Tank (without tile fields)	22	23
Septic Tank and Tile Field	20	21
Leaching Pit	13	14
Pit Privy	26	27
Other	1	1
Unknown	1	1
No Disposal System	6	6
No Disposal Wash Water	7	7
	96	

Table II

Distance Sewage Disposal From Lake

	Number	% of Total
< 25	1	1
26 - 50	7	8
51 - 100	14	16
> 100	67	75
	89	

APPENDIX J

Table I

Drinking Water Source

		Number	% of Total
Lake		4	8
Well	Dug	6	12
	Drilled	11	21
	Sand Point	4	8
Spring		2	4
Hauled		15	29
Unknown		9	18
		51	

Table II

Drinking Water Treatment

	Number	% of Total
None	11	21
Boiled	1	2
Filtered	0	0
Chlorine	1	2
Unknown	38	75
	51	

APPENDIX K

Drinking Water Sample Results Exceeding M.O.E Guidelines

	Number	Percent
Iron	6	43
Chloride	0	0
Sodium*	1	7
Colour	12	86
Turbidity	6	43
Nitrate	1	7
Total Coliform Organisms	2	14
Fecal Coliform Organisms	0	0

Number of Wells Sampled 14

M.O.E. Standards

Nitrate	10 mg/L
Iron	0.3 mg/L
Chloride	200 mg/L
Colour	5 Hazen Units
Turbidity	1 Formazin Unit

* Sodium 20 mg/L (interim guideline)

Total Coliform Organisms	< 2
Fecal Coliform Organisms	0

APPENDIX L

Silver Lake Water Quality - Chemical

	Sample Location					
	South End	Western End	Northwest End	North End	Northeast End	Southeast End
Hardness as $CaCO_3$ (mg/L)	156	156	156	156	156	156
Alkalinity as $CaCO_3$ (mg/L)	140	141	141	---	141	---
Iron as Fe (mg/L)	0.02	0.16	0.16	0.10	0.11	0.11
Chlorides as Cl (mg/L)	2	3	2	2	3	2
pH	8.5	8.5	8.4	8.5	8.6	8.6
Colour (Hazen Units)	< 1	9.1	7.4	7.2	8.1	7.7
Turbidity (Formazin Units)	1.1	1.6	1.2	1.3	1.4	1.1
Conductivity (µmhos/cm)	260	270	251	263	252	269
Nitrogen as N						
Total Kjeldahl (mg/L)	0.6	0.8	0.4	0.4	0.6	0.4
Nitrite (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nitrate (mg/L)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Phosphorus as P (mg/L)	0.02	0.02	0.02	0.02	0.02	0.02
Suspended Solids (mg/L)	< 15	< 15	< 15	< 15	< 15	< 15
Dissolved Organic Carbon (mg/L)	5.7	5.8	5.8	5.8	5.8	5.7

GLOSSARY

A. BACTERIOLOGICAL EXAMINATIONS

1. Coliform Bacteria

The direct search for a specific pathogen in water is too uneconomical and slow for routine control purposes. Instead water is examined for an indication of fecal contamination by using specific groups of bacteria as indicators. When these groups are found in the water it is assumed that the water is potentially harmful. The standard group of micro-organisms used as an indicator is the coliform group which includes all aerobic and facultative anaerobic, Gram-negative, nonspore forming, rod-shoped bacteria that ferment lactose with gas formation within 48 hours at 35°C. Organisms of the Escherchia coli strains which are usually of fecal origin, and of the intermediate and Aerobacter aerogenes strains which are usually but not always of soil, vegetable, or other non-fecal origin are included in this group.

1 (a) Total Coliforms

This group comprises species that are commonly associated with fecal matter (human and animal) and normal inhabitants of soil and vegetation. The presence of total coliforms in water may indicate contamination from soil runoff, or, less recent fecal pollution.

1 (b) Fecal Coliforms

These bacteria are mainly species associated with human and animal fecal matter. The presence of fecal coliforms in water indicates a relatively recent and near pollution input.

B. CHEMICAL ANALYSES

1. Alkalinity

Alkalinity is the measure of the power of a solution to neutralize hydrogen ions. It is used to define the buffering capacity (the capacity to resist changes in pH) of water. Alkalinity is expressed in terms of an equivalent amount of calcium carbonate. This does not necessarily imply that there is this much calcium carbonate in the water or that there is any at all. The alkalinity measurement represents the quantity of acid, expressed as calcium carbonate, needed to reduce the pH of a measured portion of sample 4.5. It is caused by the presence of carbonates, bicarbonates, and hydroxides, and to a lesser extent by the presence of borates, silicates, phosphates, and organic substances. Alkalinity is not considered detrimental to human health but it is generally associated with high pH values, hardness and excessive dissolved solids.

2. Colour - Apparent

Apparent colour includes colour due to dissolved solids and suspended matter. Surface water colour is due mostly to the presence of humic acids derived from decomposition of plant material. In groundwaters colour is usually due to the presence of iron and manganese. Most naturally coloured water (usually yellowish-brown) is harmless. The objective for domestic water supplies in Ontario is 5 Hazen Units.

3. Chloride

Chloride concentrations in water supplies may result from contact with natural minerals, industrial and agricultural wastes, or human and animal sewage. Urban runoff often contains high concentrations of chloride in the winter due to the application of road salt. Chlorides are generally not harmful. Allowable concentrations in drinking water are based on palatibility requirements rather than on health considerations. The water quality objective for domestic drinking water supplies in Ontario is 250 mg/L.

4. Conductivity

Conductivity is defined as the reciprocal of a water's electrical resistence (in ohms) between two electrodes one square centimeter in area and one centimeter apart at a standard temperature at 25°C. It is a measure of the ion concentration in water. In natural waters conductivity is mainly due to calcium, magnesium, sodium, potassium, bicarbonate, chloride, sulfate, and nitrate ions. Conductivity can be correlated with dissolved solids content. In Ontario the dissolved solids content is equal to 0.65 $\pm$ 0.10 times the conductivity. The permitted level for conductivity in drinking water in Ontario is indirectly established by the limit for dissolved solids.

5. Hardness

Hardness, defined as the soap neutralizing power of water, can be expressed in terms of an equivalent concentration of calcium carbonate. Hardness is mainly attributable to the presence of calcium and magnesium ions resulting from the natural accumulation of salts during contact with soil and geological formations. Hardness is objectionable because it reduces the efficiency of soap and it can produce scums and scales. Hardness in drinking water is limited indirectly by the criteria for dissolved solids (maximum of 500 mg/L). Concentrations over 120 mg/L become increasingly inconvenient.

6. Iron

Iron is the most abundant of the heavy metals in nature but despite this abundance it is generally found in relatively low concentrations in natural surface waters. In groundwater, however, conditions may be such that high concentrations of iron remain in solution. Iron concentrations occur in water due to the leaching of soluble iron salts from soil and rocks. Iron is non-toxic even at high concentrations but becomes objectionable in water because of the taste and odour it imparts. It also tends to precipitate as hydroxides staining laundry and porcelain fixtures. Also, ferric iron combines with the tannin in tea to produce a dark violet colour. The water quality objective for drinking water in Ontario (0.3 mg/L) is based on aesthetic and taste considerations.

7. Manganese

Manganese is a common element in nature and found in numerous minerals which include pyrolusite, braunite, manganesespat. It is essential in trace quantities for the proper nutrition of both plants and animals. Although manganese is non-toxic at levels commonly encountered in water supplies, it can cause unpleasant tastes and stain laundry and plumbing fixtures. Iron and manganese are commonly found together.

8. Nitrate Nitrogen

Nitrates are the end products of the aerobic stabilization of organic nitrogen and as such they occur in polluted waters that have undergone self-purification. They can occur in groundwater as a result of leachings from cesspools or fertilized soil. Photosynthetic action is constantly utilizing nitrates and converting them to organic nitrogen in plant cells but in groundwater this action is not possible and high concentrations of nitrates can result. Nitrates are undesirable because their nutritive properties promote the growth of algae and other aquatic plants. Although nitrates are considered non-toxic to adults, high levels in domestic water supplies can lead to a condition known as infant methemoglobinemia in which the oxygen carrying capacity of the blood is inhibited. The maximum acceptable level of nitrates for domestic water supplies in Ontario is 10 mg/L if the water is to be used for infant feeding.

9. pH

The symbol pH is used to designate the logarithm (base 10) of the reciprocal of the hydrogen ion activity. In the case of natural waters the hydrogen ion activity closely approximates the hydrogen ion concentrations in moles per litre. Although the hydrogen ion is a potential pollutant in itself, pH is also intimately related to the concentrations of many other substances. The degree of dissociation of many substances is influenced by pH and since the undissociated compounds are frequently more toxic than the ionic forms pH may be a highly significant factor in determining limiting concentrations. Also the hydrogen ion concentrations is important because it affects the taste and corrosivity of water and the efficiency of chlorination.

10. Sodium

Sodium ranks sixth in the natural order of elemental abundance and is normally the principal ion in brackish or saline groundwater. It is important for all life forms and is generally considered non-toxic. Patients with high blood pressure however are usually warned to avoid the consumption of water containing high concentrations of sodium. Waters softened by the ion-exchange process employed in most domestic water softening equipment, generally contain high levels of sodium.

11. Sulfates

Sulfates occur naturally in water as a result of leachings from minerals. Sulfates may also occur as the final oxidized stage of sulfides, sulfites, and thiosulfates, as the oxidized state of organic matter in the sulfur cycle and as a result of industrial wastes. Water high in sulfates tends to form hard scales on plumbing and increase the corrosiveness of water towards concrete. Under anoxic conditions sulfates serves as an oxygen source for bacteria which convert it to hydrogen sulfide gas. The maximum sulfate concentrations permissible for domestic water supplies in Ontario is 250 mg/L. Although the limit is not based on taste or physiological considerations, concentrations over the limits may exert a cathartic effect on the gastro-intestinal tract.

12. Turbidity

Turbidity is a measure of the optical properties of a water sample. It is attributable to suspended and colloidal matter which diminishes the penetration of light. Turbidity is useful in assessing water clarity. In Ontario turbidity is measured in Formazin Units.

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